REMARKS

The above amendments are made in response to the first Office Action mailed on September 7, 2005, wherein:

1. Claims 27 and 30-32 were rejected under 35 U.S.C. §102 as being anticipated by T.F. Tseng, *et al.*, entitled "Effect of $LaNiO_3$/Pt double layers on the characteristics of $(Pb_xLa_{1-x})(Zr_yTi_{1-y})O_3$ thin films" **(the "Tseng article")**;
2. Claims 27 and 30-32 were rejected under 35 U.S.C. §102 as being anticipated by A. Li, *et al.*, entitled "Preparation of epitaxial metallic $LaNiO_3$ films on $SrTiO_3$ by metalorganic decomposition for the oriented growth of $PbTiO_3$," **(the "Li article")**;
3. Claims 27 and 30-32 were rejected under 35 U.S.C. §102 as being anticipated by C.H. Lin, *et al.*, entitled "Domain structure and electrical properties of highly textured $PbZrTiO_3$ thin films grown on $LaNiO_3$-electrode buffered Si by metalorganic chemical vapor deposition" **(the "Lin article")**; and
4. Claims 27-32 were rejected under 35 U.S.C. §103 as being obvious over each of the Tseng, Li, and Lin articles, taken separately, in view of C. R. Cho, et al., entitled "Solution deposition and heteroepitaxial crystallization of $LaNiO_3$ electrodes for integrated ferroelectric devices" **(the "Cho article")**.

With this Amendment, Claims 1-26 have been canceled ***without prejudice*** in response to a restriction requirement, Claim 27 has been amended to include subject matter from Claim 28, Claim 28 has been canceled ***without prejudice***, and Claims 27 and 29-32 have been amended to correct obvious typographical errors. New Claim 33 has been added, and is supported by the original Specification at paragraph **[0035]**. Applicants respectfully submit that no new matter has been entered by these amendments. Applicants provide the reasons as to why amended Claim 27 and its dependent Claims 29-33 are allowable. **In summary, Claims 27-32 and new Claim 33 are pending in the application.**

Response to the Rejection of Claims 27 and 30-32 under 35 U.S.C. §102 over the Lin Article

Among other inventive features, amended independent Claim 27 recites a lanthanum nickel oxide layer having "a non-amorphous microstructure that comprises grains of crystalline material, the grains having an average diameter in the range from 100 Å to 300 Å." At page 117,

the Lin article indicates that its lanthanum nickel oxide layer (abbreviated as the "LNO layer") "shows columnar grains with average grain size around 50-80 nm" (see the last sentence on the left-hand column extending over the first line of the right-hand column). The range of 50-80 nm (nanometers) is equivalent to a range of 500 Å to 800 Å (since 1 nm = 10 Å). Thus, this passage from the Lin article indicates that the average diameter of the grains in Lin's lanthanum nickel oxide layer is at least 200 Å larger than the upper end of the range recited by amended independent Claim 27. The Undersigned could not find any indication in the Lin article of a smaller average grain size. Accordingly, since the Lin article fails to teach or suggest the range of average grain diameter recited by Claim 27, it is respectfully submitted that the Lin article does not anticipate Claim 27 (M.P.E.P. §2131, Section entitled: "TO ANTICIPATE A CLAIM, THE REFERENCE MUST TEACH EVERY ELEMENT OF THE CLAIM"). Accordingly, applicants respectfully request that this rejection of Claim 27 and its dependent claims 30-32 be withdrawn.

Response to the Rejection of Claims 27-32 under 35 U.S.C. §103 over the Lin Article in view of the Cho Article

The Rejection of Claims 27-32 under 35 U.S.C. §103 argues that the Lin and Cho articles "are silent about the average diameter of the grains of the LNO film" (Office Action, page 4, second paragraph). (Applicants do not dispute this as to the Cho article, but respectfully disagree with respect to the Lin article based on Applicants' above arguments.) Nonetheless, the rejection argues that "[i]n view of the prior art teachings, one of ordinary skill in the art would control grain size because it affects the bonding reliability between the ferroelectric material and the substrate." However, this asserted motivation does not indicate how the grain size would be controlled to achieve the alleged benefit of better bonding reliability (*i.e.*, whether one of ordinary skill in the art would ***increase*** the average grain size or ***decrease*** the average grain size from the values of 500 Å to 800 Å stated in the Lin article). For this reason, the proffered motivation of the rejection is not sufficient to establish a *prime facie* combination, and the rejection should therefore be withdrawn. Action to that end is respectfully solicited.

Moreover, from the experience of the Undersigned, the action of increasing the average grain size from that disclosed by the Lin article would make the LNO layer look more like a pure crystalline layer (*i.e.*, substantially one single crystal), which is typically considered by those of

ordinary skill in the art to be an ideal bonding surface. Therefore, assuming for the sake of argument that the statement to "control the grain size because it affects the bonding reliability between the ferroelectric material and the substrate" were to be given to one of ordinary skill in the art to consider with the Lin article, that person would likely think to increase the average grain size of Lin's LNO layer beyond his values of 500 Å to 800 Å. However, such action would take the Lin article further away from Claim 27's recited range of 100 Å to 300 Å. Thus, the Undersigned respectfully submits that if the proffered motivation were to be given to one of ordinary skill in the art, it would lead that person away from Claim 27, not toward it. The Undersigned also respectfully submits this as a further reason as to why this Rejection of Claim 27 and its dependent claims is improper and should be withdrawn. Action to that end is respectfully solicited.

It is respectfully noted that the Cho article was only cited in this Rejection against the subject matter of dependent Claims 29-32, which relate to surface roughness and resistivity. This Rejection did not rely upon the Cho article to teach or suggest the average grain diameters recited by amended Claim 27 and original dependent Claim 28. Accordingly, Applicants' above arguments for the patentability of amended Claim 27 did not need to specifically address the Cho reference.

Response to the Rejection of Claims 27 and 30-32 under 35 U.S.C. §102 over the Tseng Article

As admitted by the Office Action, the Tseng article does not explicitly disclose grain sizes or an average grain diameter. Accordingly, the Tseng article does legally anticipate amended Claim 27 and its dependent claims, and therefore this Rejection should be withdrawn. Action to that end is respectfully requested.

Response to the Rejection of Claims 27 and 29-32 under 35 U.S.C. §103 over the Tseng Article in view of the Cho Article

As admitted by the Office Action, the Tseng article does not explicitly disclose grain sizes or an average grain diameter. However, the Tseng article uses two LNO-layer formation methods, one of which is substantially the same as that used in the Lin article. Therefore it can be

reasonably inferred that some of LNO layers of Tseng article have substantially the same average grain diameter as that described in the Lin article. Specifically, the Tseng article uses radio-frequency (RF) sputtering (see abstract) to form some of its LNO layers, whereas the Lin article uses RF Megatron sputtering (see page 116, right-hand column, first sentence under the section heading "EXPERIMENTAL PROCEDURE"). It is the experience of one of the inventors (Michael Lee) that regular RF sputtering and RF Megatron sputtering produce substantially the same average grain diameters, but that RF Megatron sputtering provides higher deposition rates.

Accordingly, as to those layers formed in the Tseng article by RF sputtering, Applicants apply the same arguments made above with reference to the Lin and Cho articles to the rejection based on the Tseng article. Namely, that Tseng's average grain diameter for LNO layers formed by RF sputtering, as inferred by the deposition method being substantially the same as that in the Lin article, is greater than the range recited by Claim 27, and therefore does not anticipate Claim 27. Further, the motivation proffered by the rejection is improper because it is not sufficient to establish a *prime facie* combination, and if it were nonetheless given to one of ordinary skill in the art, it would lead that person away from Claim 27.

The Tseng article does disclose a second method of forming its LNO layer, that method being pulsed layer deposition (PLD). However, the Tseng article does not disclose an average grain size for this method, and neither the Undersigned nor the Applicants can, at this point in time, infer what that grain size might be. Nonetheless, it is the Examiner's burden of proof to show what the grain size produced by Tseng's PLD method is. But more importantly, it is respectfully submitted that the motivation proffered by the rejection is improper because it is not sufficient to establish a *prime facie* combination, as indicated above. In addition, if it were nonetheless given to one of ordinary skill in the art, it would lead that person away from Claim 27.

<u>Response to the Rejection of Claims 27 and 30-32 under under 35 U.S.C. §102 over the Li Article; and Response to the Rejection of Claims 27 and 29-32 under under 35 U.S.C. §103 over the Li Article in view of the Cho Article</u>

As admitted by the Office Action, the Li article does not appear to explicitly disclose grain sizes or an average grain diameter for its LNO layer. However, the Li article does disclose that a $PbTiO_3$ layer (abbreviated as "PT layer" in the Li article) formed above its LNO layer has a grain size of ~100 nm, which is equal to ~1,000 Å (see page 163 of the Li article, left-hand column, seventh line from the bottom). Li's PT layer is formed by a sol gel method (page 163, left-hand column, lines 9-10 from the top), and thus the grain structure of the PT layer should be the same as, or smaller than, the grain structure of the LNO layer since the formation of the grains in the PT layer by the sol gel method depends upon the underlying grain structure of the LNO layer. Therefore, the Undersigned respectfully submits that it can be reasonably inferred that the grain sizes of Li's LNO layer are larger than the ~1,000 Å grain sizes of Li's PT layer.

Accordingly, Applicants apply the same arguments made above with reference to the Lin article to the Li article. Namely, that Li's average grain diameter for LNO layers is greater than the range recited by Claim 27, and therefore does not anticipate claim 27. Further, the motivation proffered by the Rejection of controlling the grain size is improper because it is not sufficient to establish a *prime facie* combination, and if it were nonetheless given to one of ordinary skill in the art, it would lead that person away from Claim 27.

<u>Further Reasons for the Patentability of Dependent Claims 30-32</u>

Each of Claims 30-32 recites a resistivity value that is that is less than 330 $\mu\Omega\cdot cm$ for a lanthanum nickel oxide layer having a non-amorphous microstructure that comprises grains of crystalline material. As pointed out by several of the references, lanthanum nickel oxide has a resistivity of ~225 $\mu\Omega\cdot cm$ at room temperature ***when the material is in a single-crystal form.*** Multi-crystal forms of the material have room-temperature resistivities that are significantly higher than this value due to imperfections in the multi-crystal forms.

The lowest room-temperature resistivity value reported for a layer in multi-crystal form in the Tseng article is $0.55 m\Omega\cdot cm = 550\ \mu\Omega\cdot cm$, which is more than 220 $\mu\Omega\cdot cm$ beyond the upper limits recited by Claims 30-32 (see the Tseng article, page 2506, left-hand column, second

paragraph from the bottom). The Rejection alleges that the Tseng article discloses a value of 50 μΩ·cm for its LNO layer. However, this value is for the combined sheet resistivity of two layers, an LNO layer and a platinum (Pt) layer, the latter of which is much more conductive than LNO. At page 2506, right-hand column, lines 12-14, and at page 2507, right-hand column, lines 8-13,Tseng indicates that this low resistivity value is provided by the platinum (Pt) layer.

The lowest room-temperature resistivity value reported for an LNO layer in multi-crystal form in the Li article is 3.4×10^{-4} Ω·cm = 340 μΩ·cm, which is more than 10 μΩ·cm above the upper limits recited by Claims 30-32 (see page 162, right-hand column, lines 11-12). The value recited in the Li article at page 161, left-hand column, second paragraph, is the single-crystal value, not a multi-crystal value.

The Lin article does not appear to disclose a room-temperature resistivity value for an LNO layer in multi-crystal form. It discloses the single-crystal value of 225 μΩ·cm at page 116 (left-hand column) and page 117 (right-hand column). The Lin article also discloses the combined sheet resistivity of an LNO layer and a combination platinum-titanium (Pt/TI) layer, the latter of which is much more conductive than LNO. The combined sheet resistivity is 56.2 μΩ·cm, which Lin indicates is significantly lower that the single-crystal value of 225 μΩ·cm "owning to the parallel conductance of the Pt underlayer" (Lin, page 117, right-hand column, lines 12-18).

The lowest room-temperature resistivity value reported for an LNO layer in multi-crystal form in the Cho article is 340 μΩ·cm, which is more than 10 μΩ·cm above the upper limits recited by Claims 30-32 (see page 3014, right-hand column, lines 15-16). The values of 80 μΩ·cm and 230 μΩ·cm recited in the Cho article at page 3014, right-hand column, last lines are not at room temperature, but at 5 degrees Kelvin. According to the well-held convention, unless a temperature is specified for a measured resistivity value, the value is measured at room temperature. The claims and the present application adhere to this convention.

Accordingly, the Tseng, Li, and Cho articles do not anticipate the recited features of dependent Claims 30-32 since these articles disclose room-temperature resistivity values for LNO layers in multi-crystal form that are above 330 μΩ·cm. In addition, the Lin does not anticipate the recited features of dependent Claims 30-32 since it does not disclose a room-temperature resistivity values for LNO layers in multi-crystal form.

CONCLUSION

In view of the remarks made above, Applicants respectfully submit that the application is in condition for allowance and action to that end is respectfully solicited. If the Examiner should feel that a telephone interview would be productive in resolving issues in the case, she is invited to telephone the undersigned at the number listed below.

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Respectfully submitted,

Sheppard Mullin Richter & Hampton LLP
Four Embarcadero Center, 17th Floor
San Francisco, CA 94111-4106
Tel: (415) 434-9100
Fax: (415) 434-3947

Hal R. Yeager
Registration No. 35,419